I CLAIM:

1. A fatigue-resistant solder alloy comprising:
   a ternary alloy comprising tin, silver, and lead,
   said alloy providing approximately the eutectic melting temperature;
   said alloy comprising about 1.5 to 1.7 weight percent silver.

2. The solder alloy according to Claim 1, wherein said alloy comprises between 1.5 and 1.7 weight percent silver, between 36 and 38 weight percent lead, and between 60.3 and 62.5 weight percent tin.

3. The solder alloy according to Claim 1, wherein said silver percentage is approximately 1.62 weight percent.

4. The solder alloy according to Claim 1, wherein said alloy comprises approximately 1.62 weight percent silver, approximately 36.95 weight percent lead, and approximately 61.43 weight percent tin, said alloy having a eutectic melting temperature of about 176 °C.

5. An assembled semiconductor device comprising:
   a semiconductor chip including at least one bond pad having an attached metallic interconnection element, said element made of a material not capable of reflow during the attachment process;
   a substrate having at least one contact pad;
   said chip interconnection element attached to said substrate contact pad using an attachment alloy comprising a ternary alloy of tin, lead, and approximately 1.5 to 1.7 weight percent silver.

6. The device according to Claim 5, wherein said alloy comprises between 1.5 and 1.7 weight percent silver, between 36 and 38 weight percent lead, and

between 60.3 and 62.5 weight percent tin.

7. The device according to Claim 5 wherein said ternary alloy comprises about 1.62 weight percent silver, about 36.95 weight percent lead, and about 61.43 weight percent tin.

8. A method for the assembly of a semiconductor device having fatigue-resistant interconnection elements, comprising the steps of:

providing a semiconductor chip having at least one solder bump comprising an alloy of tin and lead;

providing a solder paste comprising tin and silver, said solder paste having a reflow temperature of about 221 °C, said bump alloy having a melting temperature higher than said paste reflow temperature;

bringing said solder bump in contact with said solder paste and immersing said bump partially in said paste;

supplying thermal energy to reflow said solder paste at about 235 °C;

controlling the amount of energy and time after said melting of said solder paste so that the molten paste dissolves a pre-determined amount of said solder bump to form a tin/lead/silver ternary alloy of about eutectic composition without melting said solder bump; and

removing said thermal energy to cool said ternary alloy fillet and said bump.

9. The method according to Claim 8 wherein said solder paste is a binary solder paste having a composition of 2 to 3 weight percent silver and 97 to 98 weight percent tin so that the

formation of primary Ag_3Sn plates in said fillet is avoided.

10. The method according to Claim 9 wherein said binary solder alloy paste has a composition of about 2.5 weight percent silver and about 97.5 weight percent tin.

11. The method according to Claim 8 wherein said solder paste is a ternary solder paste having up to 20 weight percent lead, up to 3 weight percent silver, and the balance tin.

12. The method according to Claim 8 wherein said bump alloy has a melting temperature higher than 275 °C.

13. The method according to Claim 8 wherein said bump alloy comprises about 10 weight percent tin and about 90 weight percent lead.

14. The method according to Claim 8 wherein said controlling of energy and time comprises a temperature above 176 °C for about 70 seconds.

15. The method according to Claim 8 wherein said ternary alloy comprises about 1.62 weight percent silver, about 36.95 weight percent lead, and about 61.43 weight percent tin.